



AEROSPACE INFORMATION REPORT

AIR1594™

REV. D

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Superseding AIR1594C

Plain Bearing Selection for Landing Gear Applications

RATIONALE

This document has been reaffirmed/revised to comply with the SAE Five-Year Review Policy.

1. SCOPE

This document is intended to give advisory information for the selection of plain bearings and bearing materials most suitable for aircraft landing gear applications. Information included herein was derived from bearing tests and service experience/reports. Airframe/landing gear manufacturers, commercial airlines, the U.S. Air Force and Naval Air Systems Command provided input for the document.

Information is given on bearing installation methods and fits that have given satisfactory performance and service life.

Base metal corrosion is a major cause of problems in bearing installations for landing gears. Therefore, methods of corrosion prevention are discussed.

Effort is directed toward minimizing maintenance and maximizing life expectancy of landing gear bearings. Lubricated and self-lubricating bearings are also discussed.

There are wide ranges of bearing load and motion requirements for applications in aircraft landing gears. For this reason, it is the responsibility of the designer to select that information which pertains to the particular application.

Anti-friction bearings, defined as rolling element bearings generally used in wheel and live axle applications, will not be discussed in this document.

Copper-Beryllium (Cu-Be) alloy material has been banned for new design by many airframers and government environmental agencies, therefore new designs are utilizing properly designed alternative bearing material such as Copper Nickel Tin (Cu-Ni-Sn) alloy.

Landing gear shock strut bearing design and selection criteria are covered in AIR5883 and, therefore, are not discussed in detail in this document.

1.1 Purpose

This document is to be used as a general reference for the aerospace community.

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2. REFERENCES

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS4533	Copper-Beryllium Alloy, Bars and Rods, 98Cu - 1.9Be, Solution and Precipitation Heat Treated (TF00, formerly AT)
AMS4534	Copper-Beryllium Alloy, Bars and Rods 98Cu - 1.9Be Solution Heat Treated, Cold Worked, and Precipitation Heat Treated (TH04, Formerly HT)
AMS4535	Copper-Beryllium Alloy, Mechanical Tubing 98Cu - 1.9Be Solution and Precipitation Heat Treated (TF00, formerly AT)
AMS4590	Extrusions, Nickel-Aluminum Bronze, Martensitic 78.5Cu - 10.5Al - 5.1Ni - 4.8Fe Quenched and Tempered (TQ50)
AMS4596	Copper Nickel Tin Alloy, Bars and Rods, 77Cu - 15Ni - 8Sn, Solution Annealed and Spinodal Hardened (TX 00)
AMS4597	Copper-Nickel-Tin Alloy, Bars and Rods, 77Cu - 15Ni - 8Sn, Solution Annealed, Cold Finished and Spinodal Hardened (TX TS)
AMS4598	Copper Nickel Tin Alloy, Tubes, 77Cu - 15Ni - 8Sn, Solution Annealed and Spinodal Hardened (TX 00)
AMS4640	Aluminum Bronze, Bars, Rods, Shapes, Tubes, and Forgings, 81.5Cu - 10.0Al - 4.8Ni - 3.0Fe, Drawn and Stress Relieved (HR50) or Temper Annealed (TQ50)
AMS4880	Aluminum Bronze Alloy, Centrifugal and Continuous-Cast Castings, 81.5Cu - 10.3Al - 5.0Ni - 2.8Fe, Quench Hardened and Temper Annealed (TQ50)
AMS4881	Nickel-Aluminum-Bronze, Martensitic, Sand, Centrifugal and Continuous Castings, 78Cu - 11Al - 5.1Ni - 4.8Fe, Quench Hardened and Temper Annealed
AMS5643	Steel, Corrosion-Resistant, Bars, Wire, Forgings, Tubing, and Rings, 16CR - 4.0Ni - 0.30Cb - 4.0Cu Solution Heat Treated, Precipitation Hardenable
AIR5883	Landing Gear Shock Strut Bearing Selection
ARP5935	Use of HVOF Thermal Spray Coatings for Hard Chrome Replacement in Landing Gear Applications
AS14101	Bearing, Plain, Self-Lubricating, Self-Aligning, Low Speed, Narrow, Grooved Outer Ring, -65 °F to +325 °F
AS14102	Bearing, Plain, Self-Lubricating, Self-Aligning, Low Speed, Wide, Chamfered Race, -65 °F to +325 °F
AS14103	Bearing, Plain, Self-Lubricating, Self-Aligning, Low Speed, Wide, Grooved Race, -65 °F to +325 °F
AS14104	Bearing, Plain, Self-Lubricating, Self-Aligning, Low Speed, Narrow, Chamfered Race, -65 °F to +325 °F
AS21230	Bearing, Plain, Self-Aligning, Grooved Outer Ring TFE Lined, Wide

AS81820	Bearings, Plain, Self-Aligning, Self-Lubricating, Low Speed Oscillation
AS81934	Bearings, Sleeve, Plain and Flanged, Self-Lubricating
AS81934/1	Bearing, Sleeve, Plain, Self-Lubricating, -65 °F to 325 °F
AS81934/2	Bearing, Sleeve, Flanged, Self-Lubricating, -65 °F to 325 °F
AS81935	Bearings, Plain, Rod End, Self-Aligning, Self-Lubricating, General Specification For
AS81936	Bearings, Plain, Self-Aligning, (Cu-Be Ball, CRES Race), General Specification For

2.2 ANSI Accredited Publications

Copies of these documents are available online at <http://webstore.ansi.org/>

ANSI B4.1 Preferred Limits and Fits for Cylindrical Parts

2.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E1417 Standard Practice for Liquid Penetrant Testing

ASTM E1444 Standard Practice for Magnetic Particle Testing

2.4 U.S. Government Publications

Copies of these documents are available online at <http://quicksearch.dla.mil>.

MIL-B-8942	Bearings, Plain, TFE Lined, Self-Aligning
MIL-B-8943	Bearings, Journal, Plain and Flanged, TFE Lined
MIL-DTL-83488	Detail Specification, Coating, Aluminum, High Purity
MIL-PRF-16173	Corrosion Preventative Compound, Solvent Cutback, Cold - Application
MIL-PRF-23827	Grease, Aircraft and Instrument, Gear and Actuator Screw
MIL-PRF-32014	Grease, Water Resistant, High Speed, Aircraft and Missile
MIL-PRF-81322	Grease, Aircraft, General Purpose, Wide Temperature Range
MIL-PRF-81733	Sealing and Coating Compound, Corrosion Inhibitive
MMPDS	Metallic Materials Properties Development and Standardization